MONTHLY NOTICES

OF THE

ROYAL ASTRONOMICAL SOCIETY.

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Professor H. H. TURNER, D.Sc., F.R.S., PRESIDENT, in the Chair.

The President announced that the Council had elected Lady Huggins and Miss Agnes M. Clerke Honorary Members of the Society.

Ole Theodor Olsen, F.L.S., F.R.G.S., 116 St. Andrew's Terrace, Grimsby ;
Captain Ernest W. Owens, Local Marine Board, Dock Street, E. ;
Captain B. F. Stevens, Letts Green, Knockholt, Sevenoaks, Kent ; and
Rafel Patxot Jubert, Passeig Bonanova 64, Barcelona, Spain,

were balloted for and duly elected Fellows of the Society.

The following were proposed by the Council as Associates of the Society :—

M. G. Bigourdan, Observatoire, Paris ;
Professor G. W. Hough, Director of the Dearborn Observatory, Evanstown, Ill., U.S.A. ;
G. W. Hussey, Lick Observatory, Mount Hamilton, Cal., U.S.A. ; and
Professor Max Wolf, F.R.A.S., Astrophysical Observatory, Königstuhl, Heidelberg, Germany.

The following candidates were proposed for election as Fellows of the Society, the names of the proposers from personal knowledge being appended :—

Rev. E. Goetz, S.J., Director of the Astronomical and Meteorological Observatory, Bulawayo, Rhodesia (proposed by Rev. W. Sidgreaves) ;

A. E. Hodgson, Natal Observatory, Durban, Natal (proposed by Dr. W. J. S. Lockyer);
H. E. Zufur Jung, G.C.B., Military Minister to His Highness the Nizam, Hyderabad, India (proposed by R. Wigglesworth);
Percy Lankester, Highwood House, Kingston Hill, Surrey (proposed by Captain P. Thompson);
Thomas Robson, B.A., Science Teacher, 14 King's Road, Doncaster (proposed by J. A. Barringer); and
Benjamin Spencer Wolfe, M.A., Senior Mathematical Master, Victoria College, Jersey (proposed by Bryan Cookson).

Sixty-six presents were announced as having been received since the last meeting, including, amongst others :—

J. Boccardi, Guide du Calculateur, 2 vols., presented by the author; F. Bidschof, Katalog von 2417 Sternen für 1885·0, presented by the author; Heidelberg, Astrophys. Observatorium, Publikationen, Band 1, presented by the Observatory; J. A. C. Oudemans and J. Bosscha, Galilée et Marius, presented by Professor Oudemans; Astronomischer Jahresbericht, Band 4, 1902, presented by Dr. Wislicenus.

Extract from a Letter from Dr. Th. Albrecht, Vice-Director of the International Geodetic Bureau.

The Central International Geodetic Bureau has just received your letter of April 3, and learns with great interest of the resolution passed by the Council of the Royal Astronomical Society at their meeting on March 13, with regard to the augmentation of the International Latitude Service by a series of observations in the southern hemisphere. The Central Bureau is the more gratified at this decision, since it had proposed in June 1896, seven years before Professor Chandler, that observations should be made on the parallels of Sydney, Cape Town, and Santiago. (See *Verhandlungen der in Oktober* 1900 *in Lausanne abgehaltenen Konferenz der permanenten Kommission der internationalen Erdmessung.*). . .

[The remainder of Dr. Albrecht's letter refers to a printers' error in the proof of Mr. Chandler's letter which was sent to the International Geodetic Bureau, for which Mr. Chandler was in no way responsible, and which is corrected in the copy printed in the *Monthly Notices.*]

Potsdam: 1903 *April* 8.

Note on the Celestial Photographs made at the Yerkes Observatory by Mr. G. W. Ritchey, and recently presented to the Society.

When the photographs of the *Orion* nebula and the *Andromeda* nebula were shown on the screen at the meeting of the Society on March 13 the question was raised whether any selective process of development or printing had been used in order to preserve the detail in the bright central portions while the faint extensions are brought up. In a letter to Mr. Hinks, dated 1903 April 2, Mr. Ritchey has given the following account of his methods of development, with permission to make it known to the Society. This account was the subject of a discussion at the meeting on May 8, and the wish was expressed that it should be printed in the *Monthly Notices*.

"For ten years I have developed all my negatives with Rodinal, a concentrated (one solution) liquid developer prepared after Andresen's formula. According to directions, one part of Rodinal is to be used with thirty parts of water for normal exposures. This works slowly, and gives a rather thin negative—not strong and brilliant, but rich in detail. The directions prescribe Rodinal one part, water forty parts, for undertimed negatives; and Rodinal one part, water twenty parts, for overtimed negatives. In developing astronomical negatives I begin with a very weak solution, Rodinal one part, water 120 parts, and develop for one hour, increasing the strength of the developer gradually every ten minutes, until the proportion becomes Rodinal one part, water sixty parts, for the last ten minutes of the hour. The slow development gives faint detail; the long development gives strength; the slow delicate development, without forcing, keeps the detail fine by avoiding the spreading of the images and coarseness of grain of plate. Double stars, for example, which would appear run together on account of the spreading of the images—were developer of normal strength used—are kept sharply separated. Rodinal allows prolonged development without chemical fog; it is best to use distilled water with it.

"This procedure gives negatives without great contrasts. All plates are backed to prevent halation while being exposed in the telescope.

"But in the case of such objects as the *Orion* and *Andromeda* nebulæ something more than the above is needed if the detail in the bright central parts and the faint extensions are both to be shown on the same positive. One negative is reserved precisely as developed by the above method. For transparencies and lantern slides a second negative is exposed in the telescope, developed as above described, and the parts which are so dense that they cannot be printed are reduced locally by

the use of very weak reducing solution. Much time and care are given to this, and an attempt is made to keep the relative brightness of the various parts the same in kind, though not in degree, as in the unreduced negative, which is constantly used for comparison during the process."

On the Verification of the Newtonian Law.

By Ernest W. Brown, F.R.S.

In the *Monthly Notices* for March and June 1897 I gave the results of an attempt to find out the degree of accuracy with which the theoretical values of the mean motions of the lunar perigee and node could be determined with the new data then available. My computations in the lunar theory had proceeded sufficiently far to enable me to give accurately the parts of these motions inclusive of the squares of the eccentricities and inclinations; the remaining parts, due to the direct action of the Sun, were estimated from Delaunay's literal expressions. Owing to the fact that some of Delaunay's higher terms were rather doubtful, that they only included two powers of m at most, and that slow convergence rendered an estimate of the remainders very doubtful, it was expedient to assign possible errors to the results quite large in comparison with the magnitudes of the terms which were estimated. They were set down in the second paper as follows :—

Mean Motions per annum.

	For the Perigee.	For the Node.
Calculated,	$+146\ 434''\cdot6 \pm 1''\cdot8$,	$-69\ 679''\cdot3 \pm 1''\cdot1$;
Hansen,	$+146\ 434''\cdot0$,	$-69\ 676''\cdot8$;
Observed,	$+146\ 435''\cdot6$,	$-69\ 679''\cdot5$.

It was noted that the possible error $\pm 1''\cdot8$ prevented any new discussion in the case of the perigee, but that the smaller possible error $\pm 1''\cdot1$ showed that Hansen's theoretical result for the node was wrong by at least $1''\cdot4$.

A short time ago my calculations in the lunar theory reached a stage which made it possible to include in the theoretical values the terms of the fourth order with respect to the eccentricities, inclination, and ratio of the parallaxes, so far as these produced a sensible effect. Although the final verifications are not yet complete, the results have been tested sufficiently to permit of their publication with confidence in their substantial

accuracy: as far as the solar perturbations are concerned, I do not think that they can be in error by more than two-tenths of a second. It may also be added that the *estimated* corrections, contained in the second of the papers referred to, due to the ratio of the sum of the masses of the Earth and Moon to that of the Sun, have been tested by exact calculation and found to be right.

The Annual Mean Motions now obtained are—

	For the Perigee.	For the Node.
By calculation,	$+146\ 435''{\cdot}5 \pm 0''{\cdot}2$,	$-69\ 679''{\cdot}6 \pm 0''{\cdot}2$;
By observation,	$+146\ 435''{\cdot}6$,	$-69\ 679''{\cdot}5$;

an agreement between theory and observation which was hardly to be expected. The parts due to the Sun's action are now entirely deduced from my calculations, and the parts due to planetary action and the figure of the Earth are the same as given in the first of the papers referred to above, the former being obtained by Hansen and the latter by G. W. Hill. The observed values are also the same as those given there, the values being Hansen's, confirmed by Newcomb.

The chief point of interest in connection with these results is the degree of accuracy of the Newtonian law of gravitation at the distance of the Moon. In his *Astronomical Constants* Professor Newcomb stated that the outstanding differences between theory and observation in the motions of the perihelia of the planets, especially that of *Mercury*, could be well accounted for by assuming the law of gravitation to be $r^{-2-\delta}$ instead of r^{-2} (Hall's hypothesis), where $\delta = {\cdot}0000001574$. This value of δ would cause a correction of $1''{\cdot}4$ in the case of the Moon—almost exactly the difference that Hansen had found. Newcomb adds that the evidence afforded by this agreement in the case of the Moon's perigee is rendered nugatory by the difference $-2''{\cdot}7$ in the case of the node; a difference which the alteration in the law will not explain.

If the new theoretical values of the motions of the Moon's perigee and node are correct, the greatest difference between theory and observation is only $0''{\cdot}3$, making $\delta < {\cdot}00000004$. Such a value for δ is quite insufficient to explain the outstanding deviation in the motion of the perihelion of *Mercury*. It appears, then, that this assumption must be abandoned for the present, or replaced by some other law of variation which will not violate the conditions existing at the distance of the Moon.

Haverford College, Pa., U.S.A.:
1903 *May* 2.

Observations of Stars occulted by the Moon during the Eclipse of 1903 April 11 at the Radcliffe Observatory, Oxford. By Arthur A. Rambaut, M.A., Sc.D., F.R.S., Radcliffe Observer.

At this observatory the following occultations of stars were observed on the occasion of the lunar eclipse which took place on the night of 1903 April 11. For these observations I employed the 18-inch guiding telescope of the new 24-inch photographic equatorial, Mr. Robinson being stationed at the 10-inch Barclay equatorial. On the 18-inch I was obliged to use the guiding breech-piece, with two slides at right angles to each other, which would have been very convenient with a low-power eyepiece, enabling me to get from one point of the Moon's limb to the other with great facility. But the advantage gained in this way was more than counterbalanced by the fact that the only eye-piece with which we are as yet furnished for this breech-piece is too high (257) for this class of observation, and gives rather a confined field of view.

The times of occultations observed by me were recorded on the chronograph, with which the new instrument is electrically connected, while Mr. Robinson's observations were made by the eye-and-ear method.

As a working list we took the list of stars published by Mr. Crommelin in *The Observatory* magazine for April 1903, p. 186, the times and angles as there given for Greenwich being corrected to adapt them for the Radcliffe Observatory, Oxford, by Chevallier's method (see *Memoirs, R.A.S.*, vol. xix. p. 231).

The clock-errors used in the reductions were found from chronographic transits for my observations, and from eye-and-ear transits for observations by Mr. Robinson. The longitude adopted in the determination of G.M.T. was $5^m\ 2^s{\cdot}6$ W.

The following are the observed times of the occultations :—

No. in Schönfeld Zone −8°.	Obs.	G.M.T. of Observation. Disappearance. h m s	Ref.	Reappearance. h m s	Ref.
3537	AAR	...		11 10 17·4	(*a*)
3540	AAR	11 13 4·1	(*b*)	...	
	R	4·3	(*c*)	12 26 39·1	(*d*)
3542	AAR	11 33 60·0	(*e*)	12 21 38·2	
	R	58·8 ±	(*r*)	...	
3545	AAR	11 57 41·2	(*g*)	...	
	R	40·9	(*h*)	...	
3543 (fainter ✶)	AAR	12 4 21·8	(*i*)	...	
	R	21·3	(*j*)	...	
3543 (brighter ✶)	AAR	12 9 42·8	(*k*)	...	
	R	42·5	(*l*)	12 40 47·8	(*m*)
3544	AAR	12 47 31·2	(*n*)	...	
	R	31·0		12 55 53·7	(*o*)

Instruments.—Guiding telescope of 24-inch photographic refractor, aperture 18 inches. Power used, 257. Observations recorded on the chronograph. *Observer* : Dr. Rambaut (AAR).

Barclay Equatorial, aperture 10 inches. Wire micrometer : Power used, 88. Observations by the eye-and-ear method. *Observer* : Mr. Robinson (R).

Observers' Remarks on the Occultations.

(*a*) Two or three seconds late. (*b*) Good.
(*c*) Instantaneous ; good. Limb of Moon invisible.
(*d*) Instantaneous ; good. (*e*) Good. Seemed to hang on limb.
(*f*) The star's faint image impinged 2^s within the partially illuminated limb before disappearing. Observation rather difficult ; time uncertain 1^s.
(*g*) Instantaneous ; good. (*h*) Instantaneous ; good.
(*i*) Good. A 10^m star n.p. 3543.
(*j*) Instantaneous ; good. Disappeared within limb. (*k*) Good.
(*l*) Instantaneous ; good. (*m*) Good ; instantaneous.
(*n*) Through clouds. Limb invisible ; disappearance instantaneous.
(*o*) Good ; instantaneous.
Clouds obscured the Moon after $12^h\ 56^m$ G.M.T.

General Remarks on the Eclipse by Mr. Robinson.

$10^h\ 48^m$ G.M.T. Shadow very dense and of a smoky-brown tint. The limb in eclipse was invisible.

$11^h\ 45^m$ G.M.T. The shadow less dense now, rendering the Moon's entire periphery visible.

When the eclipse had well advanced, the Earth's shadow was observed, both in the 2·7-inch "finder" and in the 10-inch, to have a distinct penumbral fringe of a uniform width of about 2′. This band was of a slaty colour.

In this connection the following remarks of a correspondent of Mr. Robinson's (Mr. Boden, of Ilkley) may be of interest :—

"Had a good visual observation of the recent eclipse, the weather being unusually propitious, and was quite delighted with the beauteous fringe of *sky-slate* shade seen in the telescope (power about 60, lunar disc nearly filling the field) bordering the umbra during the *greater* phases, but which disappeared giving place to a border of indistinct Indian-ink hue during an interval from just before to just after semi-eclipse. Did you notice this beautiful coloured penumbra at all in your larger instruments ?"

Radcliffe Observatory, Oxford:
1903 *May* 6.

Observation of the Partial Eclipse of the Moon, 1903 *April* 11. By E. M. Antoniadi.

The weather was fine here on the night of April 11, so that the observations of the eclipse were made under favourable circumstances, the instrument used being a 3-inch achromatic, power 35.

Soon after first contact with the umbra it became evident that a "black eclipse" was developing, the shadow being so dark as to utterly blot out the limb and all topographical details of the lunar surface. As usual, however, the edge of the umbra was transparent: all along a zone extending 3′ from the border inwards, the shadow was of a diaphanous ash-grey colour, in which tinges of green, blue, and violet were alternately and repeatedly suspected.

It was only towards midnight, G.M.T., that by sweeping with the telescope right and left of the Moon, in order to gain contrast, the whole body of our satellite was seen projected as a brownish-black disc on the scarcely darker background of the sky. But to the unaided eye the eclipsed portion remained invisible.

This is the only instance, since 1887, in which I could not see the shaded limb without optical assistance. On 1891 November 15 and 1892 May 11 the colour of the shadow was of a very decided coppery red, brightening to a beautiful roseate hue near the centre of obscuration; and a comparison of these, and other impressions on past eclipses, with the recent "black eclipse" shows how the shadow can vary in colour from rose to black, and how great an interest attaches to the observation of these phenomena.

74 *Rue Jouffroy, Paris:*
1903 *May* 6.

A Possible Cause of the Moon's Obscurity on April 11. By the Rev. S. J. Johnson, M.A.

The ordinary course of an immersion of the Moon in the Earth's shadow is so uniform as to gradations of colour and other matters that it would be useless to occupy space concerning it. On the late occasion, however, the blackness of the Moon's surface was of such an intense character as only seems to have been noticed twice in England in the last century, viz. in 1816 and 1884, and once, in Tasmania, in 1885.

As the curved shadow advanced the appearance was, as usual, that of a dark bar across the S.E. portion of the Moon.

At 11.50, when the whole of the Mare Crisium had just become immersed in the shadow, this was the first and only object I was able to make out in the telescope, and it disappeared in a few minutes. A rim of light greenish-grey extended inwards 4′ from the enlightened crescent. To the naked eye the small bright crescent gave one the impression of being much brighter than it really was, probably owing to irradiation. At 12.0 the whole globe of our satellite could be discerned in the telescope, appearing of a dull faint brown colour. At $12^h\ 10^m\ 52^s$ a faint star, probably B.D. −8°, 3543, disappeared nearly at the lowest point of the disc, and $12^h\ 22^m\ 42^s$ may be taken as the time of emergence of a star, probably B.D. −8°, 3540. At the time of greatest phase, 12.13, and during the retreat of the umbra the eclipsed part of the Moon's disc was entirely of a blackish grey, not a trace of detail being visible.

The usually received explanation of this is the state of the several strata of the atmosphere with regard to transparency or with regard to saturation. On the other hand, if we take the two instances seen in our own land in the last century, 1816 was one of the wettest summers on record, and the eclipse of 1884 October 4 took place after a remarkably fine and dry summer and autumn. They happened, therefore, under directly contrary circumstances as regards meteorological conditions. The eclipse of 1884 taking place a year or so after the Krakatoa explosion, and the late one having happened after the West Indian eruption, it is difficult not to connect the two in some way as cause and effect.

If we go backwards to former occasions of abnormal darkness of the eclipsed Moon, such instances seem to have taken place a year or two after volcanic disturbances.

The eclipse of 1816 June 10 was two years after the eruptions of Mayon (Philippine Islands) mentioned by Arago. The following, however, from the *American Almanack* for 1833, p. 70, is perhaps more to the point:—

"1814 July 3 and 4. Great fall of black dust in Canada with appearance of fire. This event was similar to that of 472.—*Phil. Mag.* vol. xliv.

"1815. Towards the end of September. The sea south of India was covered to a great extent with dust.—*Phil. Mag.*, 1816 July.

"1816 April 15. Red snow in different parts of the northern region of Italy."—*Giornale di Fiscia*, &c., t. 1, 1818, p. 473."

The previous instance of a disappearance of the Moon occurred on 1761 May 18, observed by Wargentin at Stockholm, who says that "not the slightest trace of any portion of the lunar disc could be discerned either with the naked eye or with the telescope." This took place after a noted volcanic disturbance. Arago, *Popular Astronomy*, vol. ii., art. The Earth, p. 97, says: "The catastrophe which gave birth to the volcano of Jorullo (Mexico) is perhaps, says M. Humboldt, one of the most extra-

ordinary physical revolutions which the annals of our planet offer. In the midst of a continent, at a distance of thirty-six leagues from the sea coast and forty-two leagues from any active volcano, a tract of land of about twelve square kilometres was upheaved in the form of a bladder during the night of 1759 September 28–29. In the centre of a multitude of ignited cones there suddenly arose six mountains of from 1,300 to 1,600 feet above the original level of the neighbouring plains. The principal mountain, the volcano of Jorullo, has an altitude of 1,696 feet. Its eruptions continued without intermission down to the month of 1760 February."

We may well suppose that the volcanic dust in so similar an eruption to those of Krakatoa and Mount Pelée had travelled to the atmosphere of the Scandinavian peninsula by the time of the eclipse.

The previous instance seems to have been in 1642 April mentioned by Wendelinus. Arago remarks: "The Tunguragua made an explosion in 1641," also (speaking of the Philippine Islands), "Aringuay made an eruption in 1641."

As to the cases of 1620 and 1601, I have not hitherto noticed any account of previous volcanic action, but we may well believe such to have taken place, as it cannot be expected that all the eruptions in the Pacific were recorded at that date.

Wendelinus (*Eclipses Lunares*) speaks of another case of darkness of the eclipsed Moon, "a matter that Tycho has left in writing about the eclipse of 1588," and Arago says, "The two peaks, very close to each other, called the Fuegos de Guatemala, experienced terrible eruptions in the year 1586.

Something may therefore be said in support of the conjecture that the presence of volcanic dust in the upper regions of the air may be connected with the obscurity of the Moon's surface on the occasions referred to.

Melplash Vicarage, Bridport: April 18.

Eclipse of the Moon of 1903 *April* 11, *observed at the Royal Observatory, Greenwich.*

(*Communicated by the Astronomer Royal.*)

In addition to observation of occultations, preparations were made to observe the times of transit of the first and second limbs of the Moon in order to compare the diameters as found from bright and dark limbs respectively. For this purpose additional wires were inserted in the Merz refractor (aperture 13 in.) and in the guiding telescope (aperture 10 in.) of the astrographic

equatorial. Owing to clouds only a few observations were obtained, the results of which are given in the following table:—

Sidereal Time of the Passage of the Moon's Diameter.

Observer.	Instrument.	Aperture	Duration 1L and 2L Bright.	No. of transits.	Total No. of wires.	Duration 1L Bright. 2L Eclipsed.	No. of transits.	Total No. of wires.
		in.	m s			m s		
Mr. Dyson ...	Merz Refractor.	13	2 11·11	1	7			
Mr. Hollis ...	Astrographic Guiding Telescope.	10	11·44	2	14			
Mr. Crommelin	Sheepshanks Equatorial.	6·8	11·16	8	20	2 11·18	2	10

The tabular time of transit given in the *Nautical Almanac* is $2^m\ 11^s{\cdot}19$.

The eclipsed limb was extremely faint, and not considered observable by Mr. Dyson and Mr. Hollis.

Results of Micrometric Measures of Double Stars made with the 28-inch Refractor at the Royal Observatory, Greenwich, in the year 1902.

(*Communicated by the Astronomer Royal.*)

The measures were made with a bifilar position micrometer on the 28-inch refractor, focal length 28 feet. The power generally used was 670, but when the definition permitted a power of 1120 was employed for observing very close pairs. A blue glass shade was employed to diminish the light and irradiation when bright stars were observed. The observations were made in variously coloured fields or in a dark field with illuminated wires. The initials in the last column are those of the observers, viz.—

L.	Mr. Lewis.	W. B.	Mr. Bowyer.
B.	Mr. Bryant.	H. F.	Mr. Furner.

Micrometric Observations of Double Stars at the Royal Observatory, Greenwich.

Star's Name.	R.A. 1900.	N.P.D. 1900.	Position Angle.	Distance.	No. of Nights.	Mags.		Epoch 1902.	Obs.
	h m	° ′	°	″					
β 1155 ...	0 2	86 23	92·9	0·59	1	8·7	9·3	·923	L.
β 1014 ...	0 2	58 53	356·1	1·18	1	7·0	12·5	·014	L.
Oσ 2... ...	0 8	63 35	43·9	0·57	2	6·5	8·0	·466	L.
β 1027 ...	0 10	69 3	187·5	1·57	2	7·5	10·9	·469	L.

Star's Name.	R.A. 1900.	N.P.D. 1900.	Position Angle.	Distance.	No. of Nights.	Mags.	Epoch 1902.	Obs.
	h m	° ′	°	″				
β 1015 ...	0 16	78 14	117·7	0·41	1	8·4 8·6	·865	W.B.
			124·4	0·49	1	...	·923	L.
β 1093 ...	0 16	73 36	49·6	0·38	1	7·5 8·5	·884	L.
β 1225 ...	0 22	69 27	188·3	1·29	1	8·1 11·8	·923	L.
OΣ 12 ...	0 26	36 8	149·2	0·50	2	5·0 6·0	·431	B.
Σ 60 ...	0 43	32 43	225·9	5·44	1	4·0 7·6	·014	L.
			223·3	5·61	1	...	·079	B.
β 495 ...	0 43	71 52	223·3	0·54	3	8·0 8·2	·854	W.B.
OΣ 20 ...	0 49	71 22	317·0	0·42	1	5·9 7·0	·887	W.B.
Σ 73 ...	0 50	66 55	22·6	1·08	2	6·2 6·8	·827	W.B.
			21·0	1·10	1	...	·786	H.F.
β 1099 ...	0 51	30 11	320·8	0·19	1	6·1 6·5	·783	B.
β 302 ...	0 53	69 8	101·2	0·51	1	6·7 8·0	·887	W.B.
β 235 ...	1 5	39 31	96·1	0·83	2	7·2 7·3	·831	B.
Σ 113 ...	1 15	91 2	352·0	1·30	1	6·2 7·2	·953	H.F.
			356·4	1·25	1	...	·991	W.B.
β 507 ...	1 30	63 44	150·1	2·02	1	8·0 11·0	·167	L.
Σ 138 ...	1 31	82 52	38·5	1·46	1	7·3 7·3	·953	H.F.
β 1016 ...	1 44	57 25	211·5	0·89	1	8·5 8·5	·167	L.
Ho. 311 ...	1 46	65 50	189·8	0·30	1	7·5 7·7	·167	L.
			181·4	0·40	1	...	·887	W.B.
Σ 183 ...	1 49	61 41	162·0	5·31	1	7·5 8·2	·887	W.B.
OΣ 38 ...	1 58	48 10	116·8	0·44	2	5·0 6·2	·039	L.
			117·3	0·36	3	...	·118	B.
Ho. 497 ...	2 7	50 7	66·1	0·65	1	8·2 9·0	·167	L.
Σ 228 ...	2 8	42 59	90·6	0·52	1	6·7 7·6	·115	L.
			88·6	0·49	1	...	·119	B.
Σ 236 ...	2 11	38 0	259·1	1·11	1	8·5 9·3	·167	L.
OΣ 42 ...	2 27	38 8	141·8	0·14	2	7·0 7·5	·137	B.
			single				·167	L.
Σ 305 ...	2 42	71 2	315·7	3·02	3	7·3 8·2	·621	W.B.
			320·8	2·99	1	...	·786	H.F.
β 524 ...	2 47	52 5	208·4	0·24	2	5·5 6·5	·115	L.
			180·4	0·10	1	...	·079	B.
Σ 333 ...	2 53	69 4	206·8	1·13	1	5·7 6·0	·014	L.
			199·7	1·20	2	...	·529	W.B.
			205·5	1·36	1	...	·786	H.F.
β 525 ...	2 53	52 31	136·1	0·22	2	7·5 7·5	·091	L.
			130·6	0·22	2	...	·137	B.

Star's Name.	R.A. 1900.	N.P.D. 1900.	Position Angle.	Distance.	No. of Nights.	Mags.	Epoch 1902.	Obs.
	h m	° ′	°	″				
β 1173 ...	2 53	66 16	342·7	0·30	1	7·7 7·8	·014	L.
Σ 346...A.B.	3 0	65 8	268·6	0·54	1	6·0 6·0	·014	L.
$\frac{A.B.}{2}$C.			358·7	5·37	1	...	·014	L.
β 1030 ...	3 4	68 39	159·9	0·53	2	8·4 8·4	·102	L.
			157·7	0·56	2	...	·137	B.
OΣ 53 ...	3 11	51 44	233·3	0·54	1	7·2 8·0	·110	W.B.
β 533 ...	3 29	58 39	50·5	0·60	2	7·0 7·0	·137	B.
Σ 412 ...	3 29	65 52	10·5	...	1	6·6 6·7	·014	L.
			359·4	0·27	2	...	·137	B.
Σ 425 ...	3 33	56 10	90·4	2·63	2	7·3 7·3	·088	W.B.
			93·5	2·35	1	...	·953	H.F.
β 535 ...	3 38	58 2	49·7	0·90	2	3·8 8·5	·137	B.
β 880 ...	3 38	58 9	15·7	0·58	3	8·5 9·0	·147	L.
			358·1	0·52	1	...	·159	B.
β 536 ...	3 40	66 6	292·3	0·15	1	8·3 8·9	·159	B.
β 1184 ...	3 42	67 56	263·1	0·46	1	8·1 8·3	·110	W.B.
			270·7	0 48	1	...	·159	B.
OΣ 66 ...	3 45	49 30	137·2	0·62	1	7·5 8·0	·159	B.
OΣ 531 ...	4 1	52 12	131·4	2·00	1	8·5 10·2	·110	W.B.
OΣ 77 ...	4 10	58 34	135·0	0·28	1	7·0 7·5	·159	B.
OΣ 80 ...	4 17	47 46	178·0	0·45	1	6·5 7·0	·159	B.
Σ 535 ...	4 18	78 51	324·4	1·49	2	6·7 8·2	·072	W.B.
OΣ 86 ...	4 31	70 27	60·8	0·37	2	7·5 7·5	·554	W.B.
Σ 567 ...	4 31	70 44	320·2	1·87	1	8·5 9·0	·035	L.
			321·5	1·77	2	...	·529	W.B.
Σ 572 ...	4 32	63 18	201·2	3·86	1	6·5 6·5	·035	L.
			201·4	3·73	2	...	·529	W.B.
			201·4	3·57	1	...	·953	H.F.
β 883 ...	4 46	79 6	69·6	0·33	1	7·5 7·5	·014	L.
			78·3	0·30	1	...	·192	B.
OΣ 98 ...	5 2	81 39	169·6	0·74	1	5·5 7·0	·997	W.B.
β 555 B.C.	5 10	98 18	158·4	0·44	1	8·0 8·0	·006	L.
Σ 668 A.B.			199·7	10·06	1	1·0 8·0	·006	L.
β 886 ...	5 16	56 17	248·5	0·83	2	8·8 9·8	·219	L.
β 887 A.B.	5 16	56 41	189·2	0·96	1	9·0 10·0	·271	L.
A.C.			114·3	9·98	1	9·0 13·5	·271	L.
A.D.			329·0	10·32	1	9·0 12·2	·271	L.
A.E.			203·2	15·59	1	9·0 13·5	·271	L.

Star's Name.		R.A. 1900. h m	N.P.D. 1900. ° ′	Position Angle. °	Distance. ″	No. of Nights.	Mags.		Epoch 1902.	Obs.
Dawes 5	...	5 19	92 29	77·9	0·86	1	3·5	5·5	·192	B.
Σ 719	A.B.	5 24	60 32	326·3	1·00	1	7·0	8·5	·020	L.
	A.C.			348·7	15·20	1	7·0	8·9	·020	L.
Σ 749	...	5 31	63 8	174·4	0·98	1	7·1	7·2	·271	B.
				169·0	0·81	2	...		·532	W.B.
β 1240	...	5 32	59 34	330·0	0·24	3	5·6	6·0	·188	B.
β 1007	...	5 36	73 31	254·2	0·24	2	6·0	6·2	·203	B.
OΣ 118	...	5 42	69 10	306·1	0·60	1	8·0	8·8	·997	W.B.
β 560	...	5 43	60 18	149·8	0·69	1	8·0	8·5	·233	L.
Σ 779	...	5 45	51 28	180·9	0·74	1	7·2	8·3	·266	L.
Aitken 56	...	6 7	60 56	56·5	1·18	1	8·1	11·8	·233	L.
β 895	A.B.	6 14	61 31	177·7	0·38	1	7·5	7·5	·271	L.
Σ 888	A.C.			249·9	3·04	1	7·5	9·5	·271	L.
Σ 899	...	6 17	72 22	17·8	2·24	1	7·0	8·0	·997	W.B.
Σ 932	...	6 29	75 10	325·6	2·07	1	8·2	8·3	·997	W.B.
Σ 948	...	6 37	30 28	118·7	1·57	1	5·2	6·1	·290	B.
Σ 963	...	6 44	30 26	76·7	0·44	1	5·9	7·1	·290	B.
OΣ 160	...	6 48	68 43	175·7	1·22	1	6·8	9·8	·997	W.B.
Σ 1037	...	7 7	62 35	303·3	0·87	1	7·0	7·1	·192	B.
				300·0	0·75	1	...		·216	L.
				297·2	0·79	2	...		·601	W.B.
β 1023	...	7 9	63 56	294·4	0·30	2	8·4	8·5	·141	B.
Σ 1110	...	7 28	57 53	225·2	5·42	1	2·7	3·7	·205	W.B.
				223·0	5·68	1	...		·266	L.
				225·2	5·63	1	...		·301	B.
OΣ 175	...	7 29	58 50	325·6	0·64	2	6·0	6·6	·208	B.
				325·3	0·48	1	...		·205	W.B.
				325·7	0·54	1	...		·266	L.
Σ 1126	...	7 35	84 32	144·0	1·12	1	7·0	7·0	·211	L.
Procyon	...	7 35	84 28	344·9	5·39	2	1	10	·214	L.
OΣ 177	...	7 35	52 19	116·1	0·58	1	7·5	8·5	·115	B.
				130·3	0·54	1	...		·359	L.
OΣ 182	...	7 47	86 22	35·3	0·88	1	7·0	7·5	·216	L.
OΣ 185	...	7 52	88 36	30·0	0·46	1	6·8	7·0	·216	L.
Σ 1175	...	7 57	85 34	225·5	1·78	1	7·8	9·7	·216	L.
β 581	A.B.	7 59	77 25	294·4	0·48	3	8·5	8·6	·198	L.
	A.C.			198·9	4·88	2	8·5	11·0	·192	L.
Σ 1186	...	8 3	62 13	227·2	3·50	1	7·1	10·4	·348	L.

Star's Name.	R.A. 1900.	N.P.D. 1900.	Position Angle.	Distance.	No. of Nights.	Mags.	Epoch 1902.	Obs.
	h m	° ′	°	″				
Σ 1187 ...	8 3	57 28	44·5	1·88	1	7·1 8·0	·329	W.B.
Σ 1196 A.B.	8 6	72 3	357·5	1·20	2	5·0 5·7	·256	W.B.
			362·6	1·07	1	...	·301	B.
A.C.			112·5	5·49	2	5·0 6·5	·256	W.B.
			112·2	5·19	1	...	·301	B.
B.C.			126·0	5·86	2	5·7 6·5	·256	W.B.
			123·5	5·68	1	...	·301	B.
Σ 1273 A.C.	8 41	83 13	234·5	3·47	2	3·5 7·7	·214	L.
			232·3	3·34	1	...	·307	W.B.
Σ 1273...A.B.	8 41	83 13	357·5	—	1	3·8 6·0	·167	L.*
			36·7	—	1	...	·216	L.*
			25·9	—	1	...	·266	L.*
			28·7	—	1	...	·320	L.*
			280·0	0·10	1	...	·301	B.
Perrotin ...	8 46	81 17	343·7	0·70	1	7·5 9·5	·320	L.
Σ 3121 ...	9 12	61 0	22·6	0·61	2	7·5 7·8	·256	W.B.
			21·6	0·76	3	...	·275	L.
Aitken 221 ...	9 13	59 50	290·1	0·39	1	8·7 8·8	·359	L.
Ho. 43 ...	9 13	68 47	310·9	0·55	1	8·0 8·5	·205	W.B.
			304·1	0·44	1	...	·320	L.
OΣ 201 ...	9 18	61 39	223·4	1·35	1	7·5 9·0	·285	L.
			219·9	1·54	1	...	·348	H.F.
Σ 1356 ...	9 23	80 27	111·9	0·68	1	6·2 7·0	·214	B.
OΣ 208 ...	9 45	35 28	108·6	0·30	2	5·0 5·6	·345	B.
A.C. 5 ...	9 48	97 38	76·1	0·33	1	5·5 5·7	·214	B.
B.D. ...	10 9	71 33	8·1	1·38	2	8·0 8·5	·315	L.
+18°·2335			6·0	1·44	1	...	·329	W.B.
OΣ 215 ...	10 11	71 45	200·5	0·86	1	7·0 7·2	·214	B.
			207·0	0·64	2	...	·291	W.B.
			207·1	0·91	3	...	·297	L.
Σ 1424 ...	10 14	69 39	114·8	3·62	2	2·0 3·5	·277	W.B.
			115·7	3·81	3	...	·293	L.
Σ 1426 ...	10 15	83 4	179·4	0·79	1	7·8 8·3	·214	B.
OΣ 216 ...	10 17	74 9	108·2	1·14	1	7·0 10·5	·309	L.
Σ 1429 ...	10 20	64 53	254·6	0·92	2	8·3 8·3	·340	W.B.
OΣ 217 ...	10 21	72 16	152·2	0·67	1	7·3 7·8	·214	B.
			157·5	0·69	1	...	·259	W.B.

* Σ 1273 A.B. See note at end of measures.

Star's Name.	R.A. 1900.	N.P.D. 1900.	Position Angle.	Distance.	No. of Nights.	Mags.	Epoch 1902.	Obs.
	h m	° ′	°	″				
Σ 1439 ...	10 25	68 41	115·5	1·68	1	8·0 8·5	·307	W.B.
β 1074 ...	10 30	43 41	203·3	—	1	6·4 11·2	·359	L.
Σ 1457 ...	10 34	83 45	313·3	1·41	1	7·4 8·4	·307	W.B.
OΣ 224 ...	10 34	80 38	304·5	0·37	1	7·2 9·2	·309	L.
OΣ 225 ...	10 35	70 14	250·9	0·69	1	7·5 11·2	·309	L.
OΣ 228 ...	10 42	66 54	184·0	0·57	1	7·2 8·1	·350	W.B.
OΣ 229 ...	10 42	48 21	322·3	0·78	1	6·7 7·1	·359	L.
Σ 1487 ...	10 50	64 43	107·3	6·47	1	5·0 7·0	·307	W.B.
Hough 47 ...	10 58	53 47	329·9	0·76	1	9 9	·359	L.
„ 378 ...	10 59	51 2	225·1	0·40	1	8·0 8·1	·359	L.
Σ 1517 ...	11 8	69 19	276·2	0·39	2	7·3 7·3	·371	W.B.
Σ 1523 ...	11 13	57 54	146·1	2·46	2	4·0 4·9	·258	B.
			144·0	2·27	1	...	·350	W.B.
Σ 1527 ...	11 14	75 11	16 5	3·38	1	6·9 8·1	·304	L.
Σ 1534 ...	11 17	71 15	330·6	5·33	1	8·0 11·2	·304	L.
Σ 1536 ...	11 19	78 55	56·3	2·42	2	3·9 7·1	·322	L.
			50·8	2·27	1	...	·397	H.F.
			51·9	2·21	1	...	·397	W.B.
Lalande 21846 ...	11 24	58 59	11·5	0·99	2	7 11	·354	L.
OΣ 234 ...	11 25	48 10	146·5	0·30	1	7·0 7·4	·350	W.B.
Σ 1555 ...	11 31	61 40	349·5	0·35	1	6·4 6·8	·214	B.
			352·4	0·48	2	...	·329	W.B.
			350·1	0·36	1	...	·345	L.
OΣ 237 ...	11 34	48 18	268·8	1·30	1	7·4 9·0	·350	W.B.
β 603 ...	11 44	75 10	320·3	0·84	1	6·4 10·2	·309	L.
Σ 1606 ...	12 6	49 33	327·4	1·12	1	6·3 7·0	·214	B.
			328·1	1·04	1	...	·350	W.B.
Σ 1639 ...	12 20	63 52	354·8	0·33	2	6·7 7·9	·315	L.
			357·5	0·31	1	...	·397	W.B.
Σ 1643 ...	12 22	62 25	39·3	2·15	2	8·4 8·7	·317	L.
			36·8	2·15	1	...	·307	W.B.
Σ 1647 ...	12 26	79 44	40·9	1·30	2	7·5 7·8	·350	L.
			38·1	1·30	1	...	·397	H.F.
Σ 1658 ...	12 30	82 0	359·0	2·38	1	8·0 9·8	·304	L.
Σ 1663 ...	12 32	68 15	104·3	0·74	2	7·8 8·7	·352	W.B.
			106·1	0·90	1	...	·397	H.F.
Σ 1670 ...	12 37	90 54	328·1	5·75	2	3·0 3·0	·404	W.B.

Star's Name.	R.A. 1900. h m	N.P.D. 1900. ° ′	Position Angle. °	Distance. ″	No. of Nights.	Mags.	Epoch 1902.	Obs.
Σ 1687 ...	12 48	68 13	84·8	1·03	1	5·0 7·8	·320	L.
			87·5	1·21	2	...	·373	H.F.
			87·1	1·18	2	...	·395	W.B.
β 112 ...	12 57	71 5	293·8	1·92	1	6·5 8·5	·320	L.
Σ 1711 ...	12 58	75 59	350·3	0·93	1	8·5 9·0	·320	L.
OΣ 260 ...	13 3	62 31	119·0	0·63	2	7·9 8·3	·307	L.
Σ 1728 ...	13 5	71 57	194·2	0·40	2	6·0 6·0	·252	B.
			193·4	0·43	2	...	·312	L.
			192·3	0·35	1	...	·392	W.B.
OΣ 261 ...	13 7	57 23	343·3	1·40	2	6·9 7·4	·427	W.B.
β 800 ...	13 12	72 27	111·9	2·84	2	7·1 10·2	·334	L.
			113·1	2·84	1	...	·348	H.F.
Lalande 24673	13 12	72 7	127·3	4·56	2	8·0 8·5	·334	L.
Σ 1734 ...	13 16	86 32	189·3	0·92	1	7·2 7·9	·304	L.
Σ 1742 ...	13 19	88 5	350·5	1·17	1	7·4 7·9	·304	L.
Hough 260 ...	13 19	60 15	328·7	0·58	1	8·3 9·5	·320	L.
OΣ 266 ...	13 23	73 47	343·6	1·53	1	7·3 7·8	·304	L.
			337·1	1·64	1	...	·416	W.B.
OΣ 269 ...	13 28	54 34	217·9	0·29	2	6·5 7·0	·449	W.B.
Σ 1768 ...	13 33	53 13	131·3	1·20	1	5·7 7·6	·290	B.
			127·4	1·38	2	...	·449	W.B.
β 612 ...	13 35	78 45	246·5	0·27	2	6·3 6·5	·335	L.
Σ 1785 ...	13 45	62 31	284·1	1·30	2	7·2 7·5	·390	W.B.
			285·0	1·16	2	...	·411	H.F.
β 1270 ...	13 59	81 2	Round	...	1	8·2 8·3	·309	L.
			Round	...	1	...	·321	L.
Σ 1808 ...	14 6	62 56	81·5	2·65	2	8·0 9·0	·407	W.B.
OΣ 278 ...	14 8	45 21	93·5	0·26	2	7·5 7·5	·487	B.
Σ 1819 ...	14 10	86 24	358·8	1·19	1	7·9 8·0	·424	H.F.
Σ 1834 ...	14 17	41 2	118·2	0·29	1	7·1 7·2	·728	B.
Σ 1835 ...	14 19	81 6	128·7	...	1	5·5 6·8	·419	L.*
Σ 1865 ...	14 36	75 51	151·5	0·54	1	3·5 3·9	·266	Big.†
			149·6	0·32	2	...	·343	L.
			150·9	0·33	4	...	·436	B.
Σ 1867 ...	14 36	58 17	14·6	1·28	3	7·7 8·2	·435	W.B.
Σ 1877 ...	14 41	62 30	328·6	2·38	1	3·0 6·3	·424	H.F.
			326·6	2·73	2	...	·452	W.B.

* Σ 1835. Distance not greater than 0″·15. † M. Bigourdan.

Star's Name.	R.A. 1900. h m	N.P.D. 1900. ° ′	Position Angle. °	Distance. ″	No. of Nights.	Mags.	Epoch 1902.	Obs.
Σ 1879 ...	14 41	79 55	132·7	0·46	1	7·8 8·8	·399	L.
			126·0	0·72	1	...	·460	W.B.
OΣ 285 ...	14 42	47 11	124·9	0·27	3	7·1 7·6	·567	B.
			124·6	0·28	1	...	·501	L.
Σ 1883 ...	14 44	83 37	250·0	0·46	1	7·0 7·0	·460	W.B.
			239·3	0·47	2	...	·509	B.
OΣ 287 ...	14 48	44 40	319·3	0·87	3	7·5 7·6	·567	B.
β 31 A.B. ...	14 48	70 51	199·2	1·54	1	8·4 9·7	·501	L.
A.C. ...			163·3	9·13	1	8·4 12·2	·501	L.
OΣ 288 ...	14 49	73 53	189·3	1·45	1	6·4 7·1	·424	H.F.
			191·1	1·58	3	...	·464	W.B.
			189·7	1·46	1	...	·501	L.
β 348 ...	14 56	89 45	114·4	0·42	1	6·0 6·8	·542	B.
Σ 1908 ...	15 1	55 7	141·5	1·39	2	8·2 9·2	·496	W.B.
Σ 1932 ...	15 14	62 48	152·6	0·80	2	5·6 6·1	·438	B.
			149·6	0·65	1	...	·460	W.B.
Σ 1937 ...	15 19	59 21	10·9	0·77	1	5·2 5·7	·320	L.
			9·9	0·78	2	...	·438	B.
			14·3	0·68	1	...	·460	W.B.
Σ 1938 ...	15 20	52 18	70·8	1·11	2	6·7 7·3	·487	B.
			73·7	1·06	2	...	·534	W.B.
Σ 1954 ...	15 30	79 7	185·8	3·53	2	3·0 4·0	·501	H.F.
			185·3	3·55	1	...	·424	L.
			181·1	3·59	1	...	·531	W.B.
Σ 1957 ...	15 31	76 44	153·3	1·23	2	7·9 9·6	·499	W.B.
OΣ 298 ...	15 32	49 52	184·5	1·23	1	7·0 7·3	·501	L.
			182·8	1·03	2	...	·613	B.
β 619 ...	15 38	76 1	1·4	0·42	1	6·5 7·0	·465	W.B.
			5·6	0·51	4	...	·479	B.
Σ 1967	15 38	63 23	120·1	0·58	2	4·0 7·0	·438	B.
			116·4	0·34	2	...	·463	W.B.
β 621	15 46	45 8	58·8	0·48	1	7·5 8·0	·728	B.
OΣ 303	15 56	76 27	145·6	0·89	2	7·4 7·9	·449	B.
			138·2	0·83	3	...	·473	W.B.
			141·6	0·72	1	...	·479	L.
Σ 2021	16 8	76 12	331·9	3·77	2	6·7 6·9	·412	W.B.
			337·4	3·45	1	...	·578	H.F.
β 951	16 19	56 23	46·9	0·84	1	8·2 8·7	·537	W.B.
			52·6	0·89	1	...	·638	L.

Star's Name.	R.A. 1900.	N.P.D. 1900.	Position Angle.	Distance.	No. of Nights.	Mags.	Epoch 1902.	Obs.
	h m	° ′	°	″				
Σ 2052	16 25	71 23	92·1	1·61	3	7·5 7·5	·482	W.B.
			93·5	1·63	1	...	·578	H.F.
Σ 2055	16 26	87 48	60·2	1·22	2	4·0 6·1	·447	L.
			56·5	1·48	1	...	·515	W.B.
			51·8	1·24	1	...	·578	H.F.
Σ 3105	16 26	96 49	32·2	0·49	3	7·7 7·7	·476	B.
Σ 2084	16 38	58 13	216·0	1·00	3	3·0 6·5	·481	L.
			215·0	0·97	5	...	·589	B.
			219·0	1·11	2	...	·596	W.B.
Σ 2091	16 39	48 37	305·0	1·16	1	7·5 8·0	·498	B.
			304·5	0·99	1	...	·633	L.
De. 15	16 41	46 20	308·1	0·57	2	8·2 8·6	·636	L.
OΣ 315 ...	16 46	88 37	152·1	0·71	1	6·2 8·1	·515	W.B.
Σ 2106	16 46	80 25	295·5	0·30	1	6·7 8·4	·512	L.
Σ 2107	16 48	61 10	339·4	0·27	3	6·5 8·0	·549	L.
			338·8	0·39	1	...	·537	W.B.
β 821	16 48	57 59	308·3	1·47	1	8·4 8·9	·633	L.
Σ 3107	16 54	85 53	98·2	1·35	2	8·5 8·5	·556	L.
			97·3	1·27	2	...	·607	H.F.
Hussey 160 ...	16 52	79 36	194·0	0·62	1	8·9 9·2	·512	L.
Σ 2114	16 57	81 24	164·1	1·37	2	6·2 7·4	·493	L.
			158·8	1·36	2	...	·518	W.B.
			164·9	1·29	1	...	·578	H.F.
Σ 2120	17 1	61 46	240·8	8·14	1	6·4 9·2	·474	L.
			242·2	8·07	1	...	·493	W.B.
			244·1	8·26	1	...	·635	H.F.
β 357	17 1	79 19	294·7	1·15	3	8·5 9·4	·503	L.
β 823	17 1	89 13	14·4	1·11	1	8·2 9·2	·512	L.
Σ 2130	17 3	35 24	143·5	2·22	2	5·0 5·1	·682	H.F.
β 1118	17 5	105 36	251·5	0·33	3	3·4 3·9	·473	B.
Σ 2140	17 10	75 30	113·1	4·74	2	3·0 6·1	·503	W.B.
			114·8	4·58	1	...	·523	L.
			112·0	4·65	2	...	·604	H.F.
Σ 3127	17 11	65 3	192·1	14·71	3	3·0 8·1	·545	L.
			191·1	14·44	2	...	·575	W.B.
Σ 2145	17 12	63 18	43·6	0·43	2	8·3 8·9	·571	L.
β 1200	17 12	75 12	8·7	1·40	1	7·8 12·2	·523	L.
β 1250	17 21	59 9	75·7	2·23	1	9·4 9·5	·638	L.

Star's Name.	R.A. 1900.	N.P.D. 1900.	Position Angle.	Distance.	No. of Nights.	Mags.	Epoch 1902.	Obs.
	h m	° ′	°	″				
Σ 2173	17 25	90 59	328·2	0·91	3	5·8 6·1	·473	B.
OΣ 331 ...	17 27	87 7	333·4	1·09	1	7·5 9·0	·570	W.B.
β 631	17 35	90 36	58·7	0·30	3	7·5 7·6	·473	B.
β 1251	17 37	74 0	63·7	1·42	1	6·0 11·5	·501	L.
Σ 2205	17 40	72 14	307·2	1·98	1	8·3 8·7	·474	L.
			306·1	2·03	2	...	·538	W.B.
Σ 2214 A.B....	17 40	46 13	214·7	19·51	1	8·5 8·8	·685	H.F.
B.C.	...		146·7	1·30	1	8·8 10·3	·685	H.F.
Σ 2215	17 41	72 15	292·7	1·12	1	5·9 7·9	·474	L.
			289·5	0·80	2	...	·534	W.B.
A.C. 7	17 43	62 13	63·3	1·54	1	9·5 11·0	·671	L.
OΣ 337	17 46	82 44	96·9	0·27	3	7·5 8·0	·503	B.
OΣ 338	17 47	74 39	14·0	0·81	3	6·5 7·0	·505	B.
			19·1	0·53	1	...	·537	W.B.
			15·3	0·67	1	...	·616	L.
*	17 48	74 28	292·7	2·18	1	9·0 9·5	·671	L.
Aitken 234 ...	17 49	64 23	32·0	0·54	2	8·8 9·1	·668	L.
„ 235 ...	17 49	64 59	61·0	0·26	2	7·9 8·1	·668	L.
A.C. 9	17 50	60 10	53·5	1·30	1	8·4 8·7	·537	W.B.
Σ 2272	18 0	87 28	212·2	1·66	9	4·1 6·1	·551	W.B.
OΣ 534 ...	18 1	78 34	274·8	2 12	1	7·5 7·5	·706	B.
OΣ 341 ...	18 1	68 34	86·3	0·32	2	6·4 7·7	·624	B.
Σ 2283	18 4	83 52	80·4	1·08	2	7·2 7·7	·575	W.B.
Σ 2281	18 5	86 2	228·6	0·36	2	5·7 7·2	·575	W.B.
Σ 2289	18 6	73 32	228·6	1·20	3	6·5 7·0	·511	W.B.
			223·0	1·31	1	...	·578	H.F.
Σ 2294	18 9	89 5	106·5	0·25	1	7·4 7·7	·542	B.
			76·6	0·31	1	...	·654	W.B.
Hussey 197 ...	18 15	79 46	32·7	0·37	1	8·2 9·3	·652	W.B.
β 641	18 17	68 32	344·7	0·78	4	7·5 9·0	·651	L.
*	18 18	69 30	338·5	2·30	1	7·5 9·0	·665	L.
*	18 18	69 30	195·1	2·60	1	8·0 9·0	·665	L.
Σ 2315	18 21	62 39	198·5	0·34	1	7·0 8·0	·665	L.
*	18 20	62 40	319·4	3·50	1	9·5 10·5	·665	L.
Σ 2318	18 21	64 4	241·5	11·93	1	8·0 10·2	·731	L.
β 1203	18 21	89 15	72·0	0·15	1	7·5 7·7	·542	B.
OΣ 354 ...	18 27	83 18	174·0	1·11	1	7·2 8·0	·685	H.F.
OΣ 357 ...	18 31	78 21	238·2	0·39	1	8·2 8·2	·590	W.B.

Star's Name.	R.A. 1900.	N.P.D. 1900.	Position Angle.	Distance.	No. of Nights.	Mags.	Epoch 1902.	Obs.
	h m	° ′	°	″				
OΣ 358 ...	18 31	73 6	13·3	1·77	2	6·8 7·2	·523	W.B.
Hough 87 ...	18 34	73 34	100·9	0·33	1	7·8 8·1	·652	W.B.
Σ 2356... ...	18 34	61 23	60·3	1·14	2	8·2 8·6	·584	W.B.
*	18 34	61 18	253·9	1·27	2	9·0 10·0	·584	W.B.
Ho. 437 ...	18 37	58 27	117·7	0·33	1	8·3 8·5	·611	L.
Σ 2367... ...	18 37	59 48	78·2	0·22	1	7·2 7·6	·611	L.
Σ 2369... ...	18 39	87 29	91·4	1·06	1	8 8	·674	B.
Σ 2375... ...	18 41	84 36	114·0	1·77	4	6·2 6·6	·666	H.F.
Σ 2402... ...	18 45	79 25	205·9	1·23	1	8·0 8·4	·652	W.B.
			207·4	1·23	1	...	·679	H.F.
β 265	18 46	78 36	230·2	1·25	1	7·7 9·3	·611	L.
Hussey 199...	18 47	78 19	6·2	0·41	1	8·7 9·1	·611	L.
Σ 2422... ...	18 53	64 2	96·9	0·95	3	7·6 7·7	·634	W.B.
β 648 ...	18 53	57 16	217·3	1·00	1	6·0 9·2	·633	L.
Σ 2424 ...	18 54	76 31	267·0	16·50	2	5·7 9·2	·681	H.F.
Σ 2437 ...	18 58	70 58	63·0	0·91	2	7·8 8·0	·611	W.B.
Σ 2455 ...	19 3	67 59	76·8	3·39	3	7·2 8·3	·695	H.F.
			76·1	3·25	2	...	·751	W.B.
Ho. 98 ...	19 4	63 4	127·5	0·27	1	8 8	·687	L.
β 1204 ...	19 7	87 33	2·3	0·31	1	7·7 8·5	·542	B.
Σ 2488 ...	19 11	70 9	326·9	1·55	2	8·5 9·7	·662	W.B.
			331·5	1·29	1	...	·679	H.F.
OΣ 368 ...	19 12	74 1	216·8	0·98	3	7·3 8·5	·622	W.B.
OΣ 371 ...	19 12	62 42	151·9	0·82	3	6·8 7·0	·651	W.B.
			153·5	0·94	1	...	·679	H.F.
β 1256 ...	19 14	83 51	36·8	0·68	3	8·3 8·3	·641	B.
β 141 ...	19 18	67 42	84·8	0·66	2	7·5 8·5	·693	W.B
β 1129 ...	19 19	37 50	339·7	0·30	1	6·3 6·3	·728	B.
Σ 2525 ...	19 23	62 52	313·2	0·43	3	8·0 8·0	·611	W.B
			313·3	0·45	1	...	·665	L.
OΣ 375 ...	19 30	72 7	146·6	0·57	3	7·2 8·4	·665	W.B.
Σ 2544 ...	19 32	81 56	240·1	16·01	1	7·8 9·5	·742	L.
A.G.C. 11 ...	19 45	71 7	156·5	0·16	2	4·5 6·0	·624	B.
Σ 2587 ...	19 46	86 10	101·3	3·72	2	6·5 9·2	·682	H.F.
Σ 2590 ...	19 47	79 55	308·6	13·42	1	7·1 10·0	·742	L.
Ho. 580 ...	19 48	67 48	273·5	0·57	1	8·0 8·1	·652	W.B.
			268·7	0·68	1	...	783	B.
OΣ 532 ...	19 50	83 50	12 3	12·13	1	3·4 11·3	·742	L.

Star's Name.	R.A. 1900.	N.P.D. 1900.	Position Angle.	Distance.	No. of Nights.	Mags.	Epoch 1902.	Obs.
	h m	° ′	°	″				
Σ 2600 ...	19 51	67 46	55·3	2·88	3	8·3 9·7	·710	W.B.
β 425 ...	19 53	69 59	241·1	1·52	3	8·4 8·5	·665	W.B.
A.C. 16 ...	19 54	63 2	59·0	0·34	3	7·8 8·2	·661	W.B.
β 439 ...	19 57	60 27	237·3	3·23	1	7·9 12·7	·671	L.
β 1258 ...	19 57	60 22	156·8	1·45	1	8·0 10·8	·671	L.
*	19 57	60 22	303·7	2·77	1	8·5 9·0	·671	L.
OΣ 395 ...	19 58	65 21	96·4	0·57	1	5·8 6·2	·570	W.B.
			99·6	0·61	1	...	·671	L.
			103·6	0·66	2	...	·701	B.
Σ 2616 ...	19 58	75 42	265·7	3·53	2	6·8 9·7	·762	W.B.
Σ 2620 ...	19 59	78 30	291·2	1·72	1	8·2 9·3	·789	W.B.
Σ 2624 ...	20 0	54 15	174·7	1·93	1	7·2 7·8	·734	W.B
Σ 2695 ...	20 28	64 32	81·0	1·09	2	6·2 8·0	·562	L.
			74·6	1·05	1	...	·734	W.B.
β 670 ...	20 28	76 24	34·1	0·59	3	8·5 8·9	·596	L.
*	20 28	76 23	135·3	0·44	2	9·0 9·5	·561	L.
β 151 ...	20 33	75 45	19·8	0·40	1	4 6	·677	L.
			20·1	0·40	4	...	·742	B.
			19·1	0·31	1	...	·734	W.B.
Ho. 137 ...	20 37	60 33	288·5	1·03	1	7·0 10·0	·734	W.B.
*	20 37	60 33	338·6	6·86	1	8·0 10·5	·734	W.B.
Σ 2737 A.B.	20 54	86 5	278·5	0·76	2	5·7 6·2	·745	B.
A.C.			74·0	10·66	1	5·7 7·4	·722	H.F.
OΣ 424 ...	20 55	74 49	318·1	0·48	1	7·5 8·7	·677	L.
OΣ 535 ...	21 10	80 24	See end of list.					
Σ 2799 ...	21 24	79 21	297·3	1·30	2	6·6 6·6	·800	H.F.
			298·7	1·57	2	...	·838	W.B.
Σ 2804 ...	21 28	69 44	334·1	2·62	2	7·3 8·0	·800	H.F.
			332·2	2·77	2	...	·811	W.B.
β 1212 ...	21 34	90 37	269·3	0·51	1	6·5 6·9	·706	B.
Hough 166 ...	21 40	62 37	90·2	0·32	3	7·5 7·5	·825	L.
Σ 2822 ...	21 40	61 42	123·4	2·34	2	4·0 5·0	·783	L.
			123·8	1·98	2	...	·800	H.F.
β 989 ...	21 40	64 49	See end of list.					
Ho. 171 ...	21 48	62 40	350·5	0·73	3	8·0 8·2	·760	L.
β 75	21 51	79 35	41·3	1·12	1	8·1 8·3	·887	W.B.
Hough 179 ...	22 8	60 17	260·2	0·42	1	8 9	·862	L.
			269·3	0·33	1	...	·887	W.B.

Star's Name.	R.A. 1900.	N.P.D. 1900.	Position Angle.	Distance.	No. of Nights.	Mags.	Epoch 1902.	Obs.
	h m	° ′	°	″				
Σ 2881 ...	22 10	60 55	99·4	1·39	2	7·7 8·2	·827	W.B.
Hough 180 ...	22 12	46 36	225·7	0·50	1	7·2 7·2	·715	L.
β 1216 ...	22 16	60 59	306·3	0·44	2	8·4 8·7	·876	W.B.
β 172 ...	22 19	95 21	0·8	0·55	1	5·6 6·0	·706	B.
Σ 2900 ...	22 19	67 39	177·8	1·37	2	6·0 9·2	·838	W.B.
β 291 ...	22 23	85 39	167·3	0·40	2	8·4 8·7	·789	L.
β 701 ...	22 23	78 12	261·4	1·03	1	7·5 10·2	·715	L.
β 1218 ...	22 23	60 49	56·2	1·45	1	8·6 8·8	·887	W.B.
β 1291 ...	22 25	32 48	122·0	3·49	1	9·1 10·5	·715	L.
Σ 2912 ...	22 25	86 5	290·1	0·36	1	5·8 7·2	·789	L.
β 705* ...	22 29	49 42	—	—	1	7·0 12·5	·715	L.
Hough 296 ...	22 36	75 59	82·7	0·29	2	5·5 5·5	·728	B.
			88·8	0·22	3	...	·828	L.
Σ 2934 ...	22 37	69 5	136·3	0·84	2	8·2 9·2	·838	W.B.
β 710 ...	22 38	60 48	235·9	0·45	2	8·5 8·6	·786	L.
β 1144 ...	22 39	60 18	95·1	0·36	1	10·1 10·1	·709	L.
β 711 ...	22 40	79 20	32·5	0·99	1	8·5 10·0	·709	L.
β 1146 ...	22 44	53 26	295·6	—	1	7·2 8·2	·917	L.
Oσ 536 ...	22 53	81 10	331·5	0·25	1	7·0 7·5	·805	B.
			344·5	0·31	2	...	·873	L.
Σ 2958 ...	22 52	78 41	11·3	4·66	1	7·2 9·5	·961	L.
Oσ 483 ...	22 54	78 48	224·7	1·06	3	6·2 7·7	·902	L.
β 1147 ...	22 58	47 47	325·2	—	1	5·5 8·7	·917	L.
β 1025 A.B....	23 2	77 52	277·5	0·80	2	8·0 10·3	·923	L.
A.C....			86·4	22·58	1	8·0 12·0	·884	L.
Σ 2995 ...	23 11	92 8	211·5	4·85	1	7·7 8·0	·922	L.
β 79	23 12	92 4	87·0	0·97	1	8·0 8·6	·922	L.
β 80 A.B. ...	23 14	85 8	9·3	0·45	1	8·2 9·1	·917	L.
			39·3	0·29	1	...	·750	B.
β 80 A.C. ...			4·7	103·95	1	8·2 10·5	·917	L.
C.E. ...			135·4	21·36	1	8·2 14·0	·917	L.
β 719 ...	23 19	76 4	5·2	1·27	1	7·2 11·0	·906	L.
β 1266 A.B....	23 25	59 44	11·1	0·20	4	7·4 7·4	·833	L.
			21·2	0·15	1	...	·783	B.
Σ 3018 A.C....			203·8	19·03	1	7·4 9·0	·799	L.
β 720 ...	23 29	59 14	348·2	0·39	3	6·0 6·5	·809	L.
			344·3	0·37	1	...	·783	B.

* See end of measures.

Star's Name.	R.A. 1900.	N.P.D. 1900.	Position Angle.	Distance.	No. of Nights.	Mags.	Epoch 1902.	Obs.
	h m	° ′	°	″				
β 858 A.B. ...	23 36	58 0	262·6	0·65	2	7·7 8·2	·858	L.
β 389 A.C. ...			52·9	22·83	2	7·7 10·8	·858	L.
Σ 3050 ...	23 54	56 50	218·4	2·18	1	6·0 6·0	·794	H.F.
β 281 ...	23 57	88 25	197·6	1·39	1	7·5 9·2	·922	L.
β 733 ...	23 57	63 26	249·7	0·75	1	6·0 11·0	·906	L.
Σ 3056 ...	23 59	56 17	149·0	0·45	2	7·4 7·4	·767	B.

Capella.

Observer ... ... Mr. Lewis.

Date. 1902.	Hour Angle.		Day from Beginning of the Year.	Position Angle.	Remarks.
d	h			°	
Jan. 24	4½	4½E.	23·1	(272)	Power 670. The nucleus is very distinct and elongated along the line in which the instrument is vibrating. The star has just the same appearance as when first seen in 1900 April. When clouds passed, the rings and glare became elliptical along this line, so that I should put the elongation down to the clock.
	4½	4½E.		(268)	
	4¾	4¼E.		(254)	
Mar. 3	11	3½W	63·5	26 36	Power 670 and 1120. Splendid definition. Large number of rings; star certainly elongated at 206° or 26°. The diameter of the star was measured first in the direction of apparent elongation and then at right angles to this direction. The difference gave 0″·12, corresponding to a separation of the centres of two stars, considered equal, of 0″·060.
Apr. 8	8¼	4 W	97·3	...	Powers 670 and 1120 Star well defined. Large number of rings. Quite round.
10	8½	4 W	99·3	...	Powers 670 and 1120. Definition fair, image steady, and a large number of rings. No sign of elongation.
Dec. 4	9	3 E.	336·3	...	Definition bad. No nucleus.

Observer ... ... Mr. Bryant.

d	h			°		
Jan. 24	4	5 E.	23·2	112	19	Power 670. Windy. Definition good at times. Apparently second quadrant.

Date. 1902.	Hour Angle.	Day from Beginning of the Year.	Position Angle.	Remarks.
d h			° ′	
Jan. 30 4	4¼E.	29·2	91 34	Power 670. Windy. Definition fair at intervals. Two blue shades and one green one.
Feb. 12 5	2¾E	42·2	49 20	Power 670. Two blue shades. Star very small. Definition good (more than six complete diffraction rings). Elongation very slight. Apparently in first quadrant.
Mar. 12 8½	2½W.	70·4	338 43	Power 670. Two blue shades. Star very bright, many rings visible. Disc at times well defined and small. Elongation estimated between 0″·05 and 0″·07. Bright field.
Apr. 9 7½	3½W.	98·3	239 32	Power 670. Definition poor, some measures through cloud, others with two blue shades.
17 7½	4 W.	106·3	211 21	Power 670. Bright sky. Two blue shades. Star very small and almost round.

Observer ... ... Mr. Bowyer.

d h			° ′	
Jan. 13 7	2¾E.	12·3	...	Power 670. May possibly be elongated at 240°, but very doubtful. Definition fair.
Mar. 17 10½	5 W.	75·4	298 38	Power 670. Definition good, several rings visible. Blue shade used. Elongation apparently in second quadrant

Schiaparelli (Σ 1273 A.B., ε *Hydræ*).

Observer ... ... Mr. Lewis.

Date.	Position Angle.	Dist.	
	°	″	
1902·167	357·5	<·2	Definition rapidly getting bad, and sky covered with thin cloud; but it is believed that the angle is fairly good. Power "670."
·216	36·7	< 1	Definition fair. Power 670.
·266	25·9	·18	Definition good. Estimated distance not greater than 0″·2.
·320	28·7	<·1	The dot of light measured was only visible occasionally, but I think it was the companion: it appeared slightly reddish, and right on the limb of the large star. The distance would not exceed 0″·1. Power 670.

Observer ... ... Mr. Bryant.

Date.	Position Angle.	Dist.	
	°	"	
1902·301	280·0	0·10	Power 670. Bright sky. Elongation slight and very doubtful.

δ *Equulei* (OΣ 535).

Observer ... ... Mr. Lewis.

1902·611	...	...	κ Pegasi (0″·13) measured fairly easily, about the same time, and judging from this δ *Equulei* must be nearly, if not quite, round.
·709	...	...	If elongated the distance cannot be anything like 0″·1. When seen at best definition it appeared round.
·715	...	...	Cannot detect any elongation. Definition not so good as on last occasion (·709).
·794	21·2	0·20	Elongation undoubted and estimated between 0″·1 and 0″·2.
·867	28·7	0·18	Elongation was marked and quite 0″·15. I suspect the companion in the first quadrant to be paler than the other.
·917	29·0	0·22	Definition good.

Observer ... ... Mr. Bryant.

1902·476	19·4	0·13	Bright field. Elongation very slight.
·542	27·2	0·18	Bright field. Not separated.
·706	28·8	0·21	Bright field. Elongated.
·783	28·7	0·22	Elongation slight.
·805	28·6	0·21	Elongated.

κ *Pegasi.*

Observer ... ... Mr. Lewis.

1902·611	180·4	0·13	Definition fair.
·709	167·3	0·1	Distance estimated.
·715	180·5	0·17	Difficult; measure of distance too large.
·805	...	...	Cannot measure, although δ *Equulei* was measured by Mr. Bryant.
·857	...	...	Cannot measure.
·862	147·9	0·14	More difficult than δ *Equulei*.
·917	145·4	0·15	„ „

Observer ... ... Mr. Bryant.

Date.	Position Angle.	Dist.	
	°	″	
1902·542	180·4	0·11	Bright field.
·706	153·8	0·16	Observation not good.
·783	157·8	0·12	Bright field.

β 705.

This star was discovered by Mr. Burnham with the 18½-inch Dearborn refractor; the magnitudes are 7·0 and 12·5. The observations:—

1878·53	158·0	1·5 ±	Burnham.
1885·64	...	...	Hermann Struve. Single.
1898·	...	...	Burnham. Single.
1902·72	74·0	0·72	Lewis. No companion could be seen in position given for 1878; but a minute companion was suspected in the position now given.

Note on the Double Star 31 *Leonis.* By S. W. Burnham.

The Anderson companion to 31 *Leonis* has not been measured until recently in the last twenty-five years, and as the bright star has a considerable proper motion there would be a very decided change in the position of the $13^{m}\cdot5$ attendant if it was only an optical pair. It was therefore placed on my working list for measurement. The following are all the observations of this pair:

	°	″	
1878·24	44·2	7·63	2*n* β
1878·30	43·3	7·94	5*n* Hl
1903·19	41·9	7·64	3*n* β

It is evident that there has been no sensible change, and that the faint star has the same proper motion as the other. This is given by Auwers as 0″·127 in the direction of 252°·6. If the companion was fixed in space the distance in this interval would have increased nearly two and one-half seconds, so there can be no doubt as to this being a physical system.

In making these measures I noticed that one of the DM

stars given as closely following 31 *Leonis* is now missing. The places from that catalogue for 1855 are :

	h	m	s	°	′
31 *Leonis*	10	0	10·3	+10	43·4
(10°) 2117 (9·5)	10	3	17·2	10	37·3
2118 (9·5)	10	3	25·2	10	38·3
2119 (9·1)	10	3	34·3	10	43·3

Neither of the three small stars is given in the A.G. Catalogue, but the last is found in the Toulouse Catalogue, and also in Bonn No. 4. Only two of these stars are to be found now. One is 2119, and the other is probably 2118, although the difference in declination does not agree with the present position of the stars. The relation of 2119 and the other star is :

1903·22 P = 185°·7 D = 73″·70

One of these stars might have some proper motion, but it is more probable that the missing star and the apparent change in position are to be explained by errors in the DM.

The small nebula, *Dreyer* 3130, is in a low-power field with 31 *Leonis*. My direct measures from that star give :

1903·22 P = 106°·9 D = 296″·6

This gives substantially the same place as that in Dreyer's General Catalogue.

The Yerkes Observatory :
April 30.

New Companion to Σ 1594. By S. W. Burnham.

The double star Σ 1594 was placed on the working list in order to make another set of measures for a determination of the proper motion shown in the prior observations. In observing the Σ companion with the 40-inch, a much nearer component was detected which has not been seen heretofore. This star was estimated $13^{m}\cdot3$, and the mean result in position is :

1903·21 P = 318°·2 D = 1″·57 3*n*

The proper motion of A, assuming C to be fixed, I have deduced from the following measures :

	°	″	
1831·93	165·0	16·95	2*n* Σ
1867·39	162·6	15·42	3*n* Δ
1879·26	160·4	15·22	1*n* β
1886·40	159·8	15·17	4*n* Hl
1903·19	158·1	14·46	4*n* β

These positions give for the most probable movement of the principal star 0″·043 in the direction of 200°·5. Struve's magnitudes of A and C are 8·7 and 10·5. The brighter is DM (42°) 2267, where it is called $9^{m}\cdot2$, and the place for 1880 from the A.G. Catalogue is :

R.A. $11^{h}\ 57^{m}\ 20^{s}$
Decl. 42° 4′ 25″

There is a more distant fourth star of about the same magnitude as the close component, which is not mentioned by Σ. The only measures are :

	°	″	
1886·40	77·3	25·15	2*n* Hl
1903·20	76·0	25·02	3*n* β

Like C, it is probably only an optical companion, but the measures do not cover a sufficient time to make this apparent.

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